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THE USE OF STILBESTROL IN FATTENING CATTLE

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CALIFORNIA AGRICULTURAL
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CIRCULAR 441

A PROFIT IS POSSIBLE

of $3 to $20 more per head for animals fattened by using the hormone stilbestrol. Results here reported indicate that at a cost of approximately 15 cents per animal (only one injection in each case) treated cattle gained ½ to 1 pound more a day than untreated cattle.

THIS CIRCULAR TELLS

what dosage of stilbestrol is needed to increase gains. It also gives information on the rate of gain, dressing percentage, carcass grade, feed consumption, and efficiency of gain.

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THE USE OF STILBESTROL in FATTENING CATTLE

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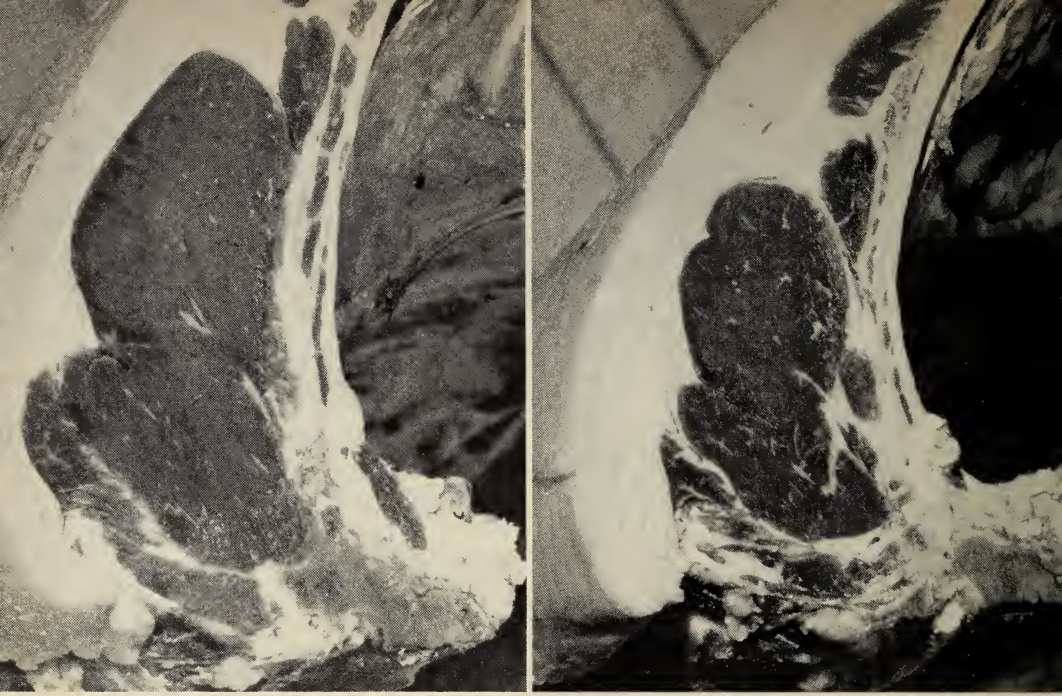
Increasing the productive efficiency of the livestock industry by the use of hormones shows great promise. Dinusson, Andrews, and Beeson of Purdue University first showed that stilbestrol increased the rate of gain of cattle in the feed lot.* Our results in ten experiments involving 599 head of cattle indicate that beef steers on full feed in the feed lot, when implanted with 60 milligrams (5 small pellets) of stilbestrol (diethylstilbestrol), gained about ½ pound more per head per day than did similar untreated animals. The cost of the stilbestrol is approximately 15¢ per animal. Only one treatment per animal is required.

Furthermore, in these tests, the treated cattle utilized their feed more efficiently. Feed records show that hormone-treated animals used from 100 to 300 pounds less feed per hundred pounds of gain than those animals not receiving treatment. Although the total amount of feed consumed by the treated animals was in excess of that of the untreated controls, the additional amount was not sufficient to overcome the far greater efficiency of gain. The net return was from $3.00 to $20.00 more per head for treated cattle.

The slaughter carcass grades for the treated animals studied in these ten tests were slightly below those of the controls, but there was no significant difference in carcass yield between the groups. Examination of the prime rib cut showed that the treated cattle carried less fat covering. Within grades there was more red, lean meat in comparison to the amount of fat. This is desirable in any carcass. Slightly less marbling occurred in the "eye" muscle of the treated animals, but the difference was not great enough to affect the carcass grade materially. On the other hand the "eye" muscle appeared to be larger.

These tests were conducted in California during 1951 and 1952. Two of the experiments were run at the University of California Experiment Station at Davis, while eight were carried out in cooperation with ranchers and farm advisors in the field. The tests covered a wide range of climatic and feed conditions and included the area extending from Modoc County on the north to Ventura County on the south.

* *The effects of stilbestrol, testosterone, thyroid alteration, and spaying on the growth and fattening of beef heifers.* Jour. Anim. Sci., 9: 321–330.



Compare the twelfth prime rib cut from an untreated steer (right) with the same cut from a treated steer (left). This is the point at which the front and hindquarters are separated. The "eye" muscle in this instance is larger in the treated steer and has less marbling; less fat covers the meat and the meat itself is slightly coarser in texture.

These animals were used

Both steers and heifers, almost exclusively of the Hereford breed, were used in these tests. The animals ranged in age from yearlings to two-year-olds. The grade and quality of cattle varied between groups, but within each test the quality and grade were comparable for treated and control animals.

In all tests, weights were secured at the beginning and end of the trial. In most cases it was impossible to obtain individual weights; therefore the cattle were separated into two uniform groups. One group was identified by tail bobbing or ear marking to differentiate it from the other. Average weights for each group were used to determine the difference in gain. Where possible, animals were individually identified. Individual weights were taken, and individual gains were determined. This method helped to establish the significance of the gains made.

And these feeds

Part of the cattle were full-fed in the dry lot, while in other tests they were grazed on irrigated pasture. Some of the animals on pasture were provided supplementary feed; in other tests no additional feed was supplied. The feeds used in the dry lot varied somewhat as far as kind was concerned, but all animals received a balanced ration. They were fed concentrates at the rate of approximately 1½ pounds for every 100 pounds of live weight. Hay was provided free-choice. Tables 1 and 2 give the general summary of each of the tests and show the age and number of cattle and the type of ration fed. In all cases these were practical rations applicable to the region where the test was conducted.

How stilbestrol was implanted

The cattle were driven into a chute and restrained in a cattle squeeze. The stil-

Table 1. Comparisons of Feed Consumption and Gain in the Feed Lot of Treated and Untreated Animals*

	Number	Age	Days on feed	Average initial weight	Total gain per animal	Average daily gain	Daily feed consumption in pounds			Pounds feed per cwt. gain	Pounds TDN per cwt. gain	Ration— approximate average daily feed consumption
							Concentrates	Roughage	Total			
U. C. Heifers												Barley 7.98 lb. Alfalfa hay 4.75 lb.
Control	10	Yrl	64	529	149	2.33	11.1	8.1	19.2	827	534	Beet pulp 2.85 lb. Oat hay 2.85 lb.
Treated	10	Yrl	64	529	162	2.52	11.3	8.2	19.5	768	495	Cottonsd. meal .57 lb.
Tulare Heifers												Barley 9 lb. Silage 3 lb.
Control	40	Yrl	135	507	245	1.83	Not available					Molasses, dried beet pulp 1½ lb. Alfalfa hay self-fed
Treated	40	Yrl	135	504	258	1.91						Cottonsd cake 1½ lb.
U. C. Steers												Barley 11 lb. Alfalfa hay 8 lb.
Control	10	Two	70	898	176	2.52	15.3	12.6	27.9	1,108	706	Molasses, dried beet pulp 4 lb. Oat hay 5 lb.
Treated	10	Two	70	889	255	3.64	15.5	13.9	29.4	806	510	Cottonsd. meal 1 lb.
Alameda Steers												Barley 6 lb. Cottonsd meal 2 lb.
Control	20	Two	91	950	178	1.96	18.2	13.9	32.1	1,644	1,038	Prunes 3 lb. Native hay 10 lb.
Treated	20	Two	91	962	240	2.64	18.9	14.4	33.3	1,261	796	Corn 4 lb. Alfalfa 4 lb.
												Molasses 3 lb.
Kern Steers												
Control	45	Yrl	115	702	294	2.56	19.8	8.9	28.7	1,120	754	Not available
Treated	44	Yrl	115	699	354	3.07	20.9	9.4	30.3	987	665	
Santa Barbara Steers												Barley 8 lb. Hay 5 lb.
Control	32	Two	107	862	237	2.12	11.8	62.0	73.8	3,332	762	Millrun 2 lb. Beet pulp (wet) 56 lb.
Treated	30	Two	107	842	288	2.69	12.1	63.1	75.2	2,882	660	Molasses 2 lb. Cottonsd. hulls 1 lb.
Ventura Steers												Barley 6 lb. Bean straw 1 lb.
Control	30	Two	115	835	284	2.47	16.8	10.7	27.5	1,115	583	Milo 3 lb. Almond hulls 1 lb.
Treated	30	Two	115	840	340	2.96	18.2	11.6	29.8	1,007	527	Molasses 1 lb. Beet pulp 1 lb.
												Alfalfa hay 10 lb. Citrus pulp 5 lb.

* All treated animals received an implantation of 60 milligrams of stilbestrol, except Ventura steers which received 120 mg.

Table 2. Comparison of Gains on Irrigated Pasture of Treated and Untreated Animals*

	Number	Age	Days on feed	Average initial weight	Total gain per animal	Average daily gain	Ration—supplement is approximate daily consumption
Colusa heifers							
Control	50	Yrl	123	490	156	1.26	Pasture—mostly tall fescue
Treated	50	Yrl	123	490	161	1.31	Supplement—first 90 days: 1 lb. barley and 3 lb. ladino clover straw. last 33 days: 3 lb. barley, 3 lb. ladino straw, and molasses self-fed
Sacramento steers							
Control	20	Two	181	757	317	1.76	Pasture—ladino and grass
Treated	20	Two	181	779	338	1.87	Supplement—last 50 days: 3–4 lb. barley
Modoc steers							
Control	47	Yrl	111	578	167	1.50	Pasture—native irrigated meadow
Treated	48	Yrl	111	565	175	1.57	Supplement—none
Tehama steers							
Control	35	Two	121	793	241	2.00	Pasture—ladino clover and mixture of grasses
Treated	35	Two	121	784	311	2.57	Supplement—5 lb. barley and hay, self-fed

* All treated animals received an implantation of 60 milligrams of stilbestrol except the Sacramento steers, which received 120 milligrams.

bestrol was administered with a poultry pellet implanter. This simple instrument, pictured here, is easy to operate and is inexpensive. In the first eight experiments the 5 pellets were placed under the skin of the neck. In the last two tests (Alameda steers and University of California steers) the same number of pellets were placed subcutaneously in the top of the ear.

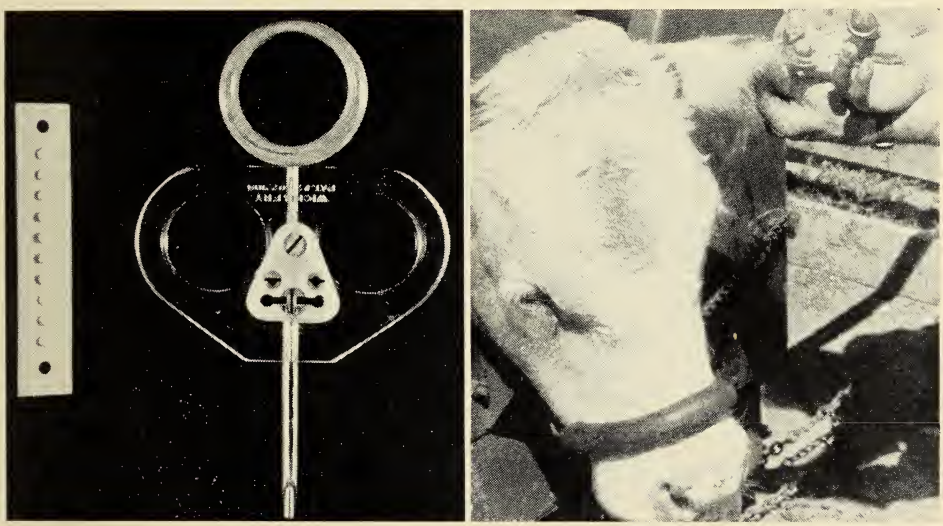
The ear is preferred over the neck region as a location for implanting these pellets. The reason is that when the animal is slaughtered the ear is removed with the hide; this eliminates the possibility of any pellets remaining with the edible portion of the meat.

It appears that the amount of material made available to the body is the important thing in hormone treatment; that is, it should be neither too high nor too low. There are indications that excessive doses may decrease gains and in addition cause many undesirable effects, to be discussed below.

Other effects of stilbestrol treatments

Stilbestrol, the synthetically produced hormone used in these studies, is an estrogen very similar to the female sex hormone normally secreted by the ovaries. Both steers and heifers displayed distinct symptoms as a result of this treatment. Some developed high tail heads. Some of the groups showed moderate to excessive riding for the first two weeks. All treated animals, both heifers and steers, had enlarged mammary glands and elongated teats. These symptoms in the majority of the cattle on test had subsided materially by the time of slaughter. In the heifers, teat and udder development 90 days after implantation was comparable to that seen in late gestation in beef cattle. At slaughter time the udders of some of the treated heifers contained considerable milk. The first signs of hormonal activity as judged by the latter symptoms occurred several weeks later with cattle on pasture as compared to those in the feed lot.

Some difficulty was had with vaginal prolapse in the treated heifers. This usually occurred about 8 to 10 weeks following the implantation of stilbestrol. In one group of heifers on irrigated pasture where the rate of gain was below normal, no trouble with prolapse occurred. The



A pellet implanter; pellets are shown in the cardboard container. Right—technique used for implanting stilbestrol subcutaneously in the ear of the animal.

reason for prolapsed vaginas is not well understood, but certainly the estrogen administration precipitated the condition. Prolapsed vaginas are not uncommon in untreated, pregnant cattle. Because of this difficulty with vaginal prolapse as well as the fact that gains made by treated heifers on full feed averaged only about .15 of a pound more than the gains made by the untreated controls, it is not recommended that heifers be treated with stilbestrol (see Table 1).

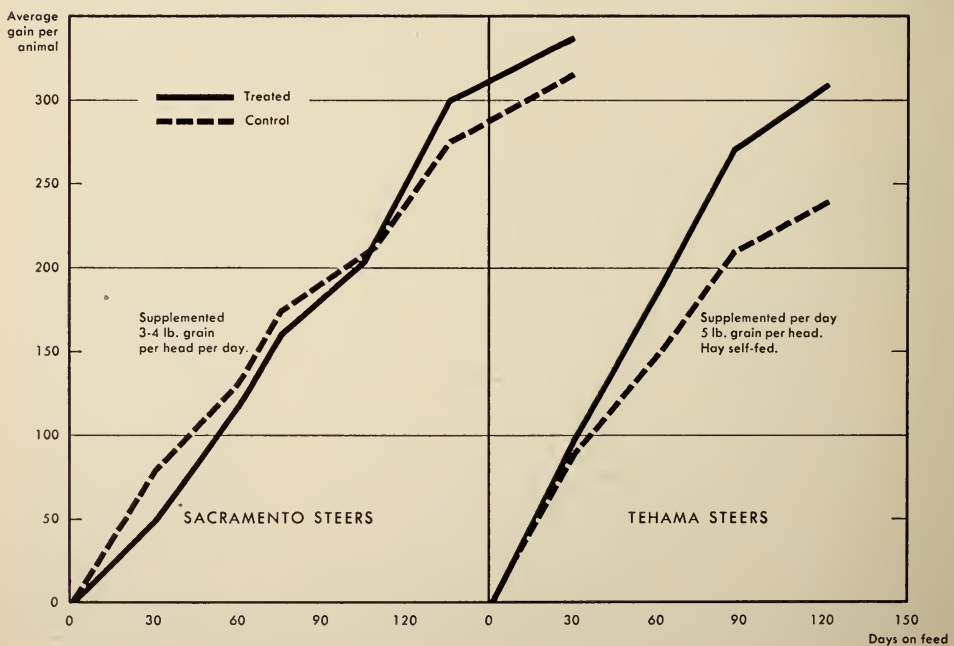
Stilbestrol-treated cattle which grazed on irrigated pasture without heavy supplementary feeding did not make any significant increase in gain over the control groups. This fact was established in three tests conducted in Sacramento, Colusa, and Modoc counties. On the other hand, in Tehama County, when two-year-old steers on irrigated pasture were supplemented daily with an average of 5 pounds of rolled barley per head per day plus cereal hay free-choice, they made a more significant gain than those animals not treated with hormones. This rate of gain over a period of 121 days was .57 of a pound per day more than the untreated group (see Graph 1).

Results of these tests indicate that cattle on pasture alone do not eat sufficient feed to obtain enough total digestible nutrients per head per day to make gains capable by this treatment.

Another interesting observation was noted in the Sacramento County test. In this trial the cattle were individually identified and then individually weighed every 30 days. The greatest gain in the treated group of steers was made by the "medium" and lower-grade cattle. These differences may not be significant, because not enough animals were in the test to provide an accurate comparison.

The pituitary and adrenal glands of the treated animals were larger than those

Graph 1. Supplemental Feed on Pasture Is Necessary to Get Higher Gain from Treated Animals



NOTE: Supplemental feeding of Sacramento steers began at 120 days. The Tehama steers were supplemented throughout trial.

Table 3. Comparison of Carcass Grade and Dressing Per Cent of Treated vs. Untreated Steers

	Number of animals	Carcass grade				Dressing per cent
		Prime	Choice	Good	Commercial	
		per cent	per cent	per cent	per cent	
Alameda						
Treated	20	..	70	30	..	59.3
Controls	20	..	80	20	..	60.1
Kern						
Treated	44	..	77	23	..	61.0
Controls	45	2	94	4	..	61.0
Santa Barbara						
Treated	30	..	53	47	..	59.6
Controls	32	..	84	16	..	60.1
Tehama						
Treated	34	..	47	50	3	60.4
Controls	36	..	56	44	..	59.8
U. C. Davis						
Treated	10	..	90	10	..	61.3
Controls	10	20	80	..	..	61.9
Ventura						
Treated	30	3	90	7	..	60.5
Controls	30	23	77	..	..	60.6

of the control cattle. Although the average weight of the thyroid gland of the treated steers was slightly heavier than the controls, the increase was not significant. On the other hand, in heifers the thyroids of treated animals were smaller than control glands. This difference, however, was also not significant. The foregoing findings help to substantiate the suggestion that the growth stimulation observed in the treated animals is due to an increased secretory activity of the pituitary gland.

Table 3 shows the slaughter data collected in six of the tests where the animals had been fattened in the feed lot. There was little difference in the dressing percentage between the animals receiving the stilbestrol and those of the control groups; nor was there any difference in the percentage of shrink in the hot and cold carcass weights between the two groups. However, the percentage of choice-to-good animals was slightly lower in the treated cattle as compared to the control groups.

The lower carcass grades in the treated groups were due mainly to less fat covering over the carcass. The meat in some cases looked dark red and slightly coarse, and the carcasses were a little heavy over the shoulder and neck regions. The carcasses from animals with raised tail heads were not so attractive to the grader and appeared to be lighter in the loins. In general, treated-steer carcasses in these tests seemed slightly "staggy" and were not very popular with some packers. The rounds of treated steers, however, ap-

peared somewhat larger than those of the control animals. In spite of the lower carcass grade in the treated groups, rate of gain, which ranged from ½ to 1 pound per head per day more for feed-lot cattle, was enough to increase the net profit significantly.

In those tests where feed consumption was recorded, feed utilization was more efficient in the treated group (see Table 1, page 5.)

The treated animals ate slightly more feed per head per day, but required from 100 to 300 pounds less feed for each 100 pounds of gain. Two factors are seemingly responsible for this increased gain—namely, increased appetite and greater efficiency of feed utilization. Therefore, if rate of gain can be increased and at the same time the amount of feed needed to produce a pound of meat can be decreased, the use of stilbestrol to

Table 4. Individual Differences in Grade of Steers in University of California Experiment Station Test at Successive Stages of the Trial

Steer number	Date graded and type of grade					
	4/16/52		5/15/52 U.S. Slaughter	6/14/52 U.S. Slaughter	6/30/52 U.S. Slaughter	7/7/52 U.S. Carcass
	U. S. Feeder	U. S. Slaughter				
Treated group						
19	Good	Commercial	Commercial	Good	Choice	Choice
20	Choice	Commercial	Good	Good	Choice	Good
3	Choice	Good	Good	Choice	Prime	Choice
17	Choice	Good	Good	Choice	Prime	Choice
10	Choice	Good	Good	Choice	Choice	Choice
9	Choice	Good	Good	Choice	Choice	Choice
13	Choice	Good	Choice	Choice	Prime	Choice
6	Good	Commercial	Good	Choice	Choice	Choice
15	Choice	Good	Good	Good	Choice	Choice
5	Choice	Good	Good	Choice	Choice	Choice
Average	Choice	Good	Good	Choice	Choice	Choice
Control group						
12	Choice	Good	Commercial	Choice	Choice	Choice
14	Choice	Good	Good	Good	Choice	Prime
8	Choice	Good	Good	Choice	Choice	Choice
18	Choice	Good	Choice	Prime	Prime	Choice
16	Good	Commercial	Good	Good	Choice	Choice
1	Choice	Good	Good	Choice	Choice	Prime
11	Choice	Good	Good	Good	Choice	Choice
4	Choice	Good	Good	Choice	Choice	Choice
2	Choice	Commercial	Commercial	Good	Good	Choice
7	Good	Commercial	Good	Choice	Choice	Choice
Average	Choice	Good	Good	Choice	Choice	Choice

bring about greater beef production looks promising.

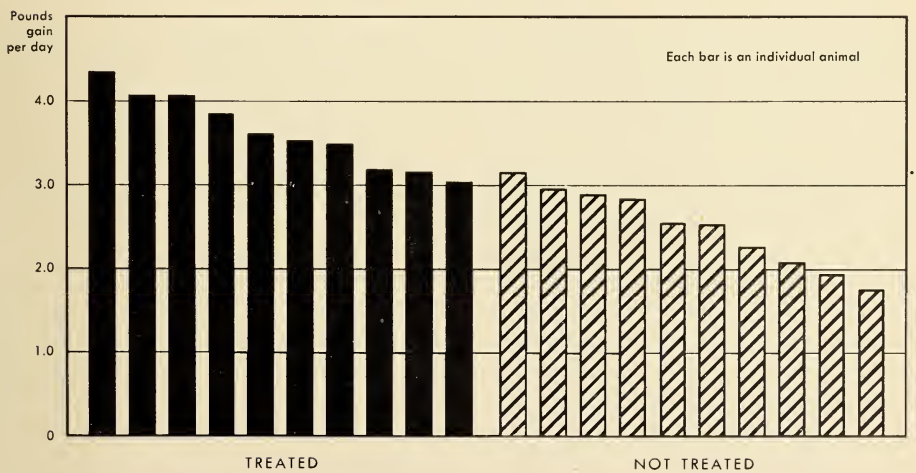
The Pure Food and Drug Administration has not approved the use of stilbestrol (for other than research purposes). To avoid contamination of the edible portion of the carcass the material was implanted in the ear of the cattle. Excellent results were secured from the ear method of implantation, a detailed discussion of which is presented here. One of two tests began in May, 1952, at the Station at Davis. A total of 20 two-year-old steers were involved in this experiment. These animals, which were grade Herefords weighing an average of 893 pounds, were bought from a feed lot and had been on feed for a short time. It was estimated that they were being fed about one-half of a full-feed ration at the time of purchase. Each steer was individually identified and was weighed and graded at the beginning and end of the test. Weights were also obtained every 14 days during the test. Table 4 presents the U. S. Feeder, U. S. Slaughter, and U. S. Carcass grades of these steers at the beginning, at two-week intervals, and at the end of the test.

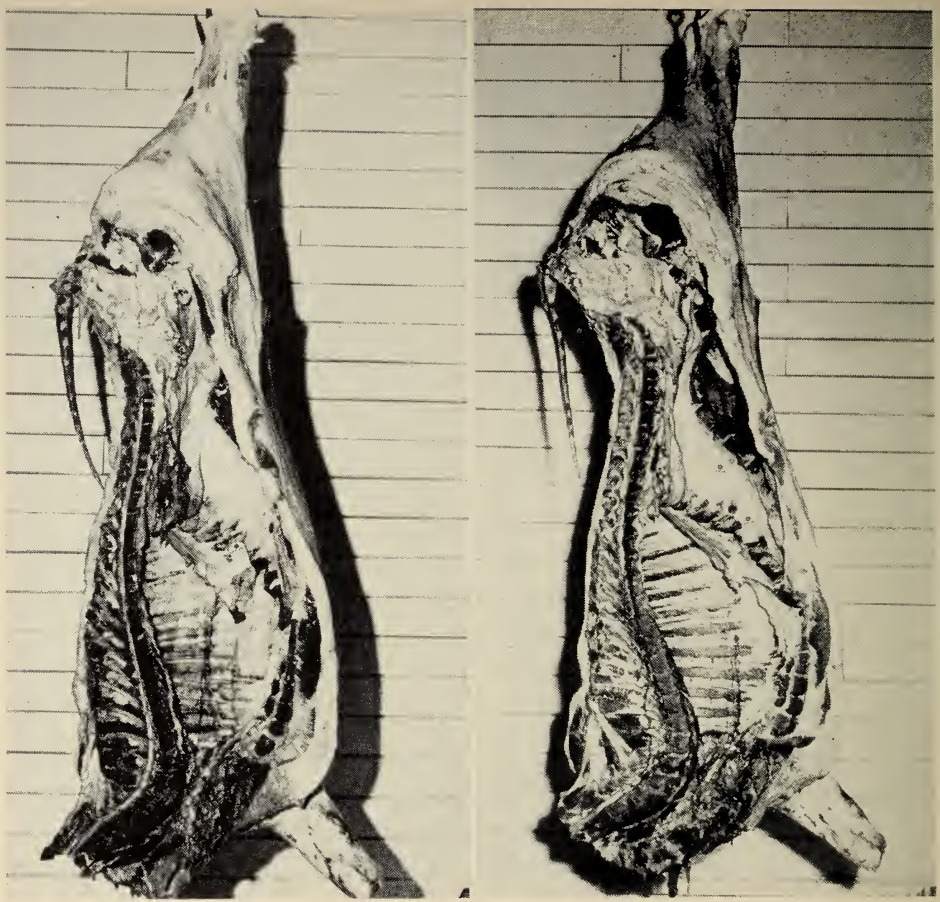
Ten of these steers were implanted with 60 milligrams of stilbestrol subcutaneously in the ear. The remaining 10 steers were used as controls.

Both groups were fed the same ration, but they were maintained in separate lots in order to record accurately the feed they consumed. During the first half of the feeding period they were fed a concentrate ration composed of barley, beet pulp, and cottonseed meal. This ration was hand-fed in open troughs twice daily. The steers ate approximately 1½ pounds of concentrates per hundred pounds of live weight during the latter part of the trial on full feed. In the first half of the trial, the steers received approximately as much concentrates as roughage. During the last half of the trial the concentrates were increased until they were receiving approximately 60 per cent concentrates and 40 per cent roughage. The roughage consisted of ⅔ alfalfa hay and ⅓ grain hay. At the end of 70 days these cattle had acquired sufficient finish for slaughter. The steers in both groups graded the same, had similar dressing percentages, and brought the same price per hundred weight.

Graph 2. Gain Per Day of Individual Steers Fed 70 Days

Steers Treated with 60 mg. Stilbestrol vs. Steers with No Treatment
University of California Test





Carcass of an untreated steer (left) compared with that of a treated steer. Both graded choice. Untreated carcass is not so full in the neck and seems to be slightly better covered over the ribs—one of the best indications of the marbling in the lean. Untreated carcass also has more internal

During this period the average gain of the treated steers was 3.67 pounds per head per day, while that of the controls was 2.49 pounds. (See Graph 2.)

A study of the carcasses indicates that the treated steers did not have either as much external fat-covering over the loin or as much internal covering in the rib region as did the control animals. The crest of the neck of the treated carcasses was more prominent than on the controls. The "eye" muscle of the treated steers was larger than that of the controls; and although it was not quite so well marbled in the treated animals, the fact that there was less fat covering would seem to make it desirable from the standpoint of less waste.

Under the supervision of the University of California Farm Advisor of Alameda County a similar test using 40 steers which graded "good" was conducted during the summer of 1952.

These cattle weighed approximately 950 pounds at the beginning of the test and were on feed for a total of 91 days. The treated group gained during that period an average of 2.64 pounds per head per day, while the controls gained 1.96 pounds per head per day. The dress-

fat—not wasteful from the standpoint of consumers. Pictures above are outside views of carcasses on opposite page. Note untreated steer (left); crest of neck is smaller and tail is less elevated. Treated steer (right) is well covered but looks a little light in the loins and heavy at crest of the neck.

ing percentage of the two groups was the same, and there was no significant difference in the carcass grades.

These cattle were fed a balanced ration composed of ground barley, prunes, corn, molasses, cottonseed meal, volunteer oat hay, and alfalfa hay. When the cattle were on full feed, they were receiving approximately 60 per cent concentrates and 40 per cent roughage. It took 1,261 pounds of feed per hundred pounds of gain for the treated animals, compared to 1,644 pounds for the controls.

In both of the tests where the estrogen was implanted in the ear, the symptoms of excessive riding and raised tail heads were not so evident as they had been in previous trials where the pellets were implanted in the neck. The greater age of the cattle in these trials probably accounts for this difference. There was considerable teat development in the treated animals, but it had almost entirely receded by the time the animals were slaughtered.

The treated cattle appeared on the hoof to be fatter and better finished than did the controls; however, they were not so neat and trim, because of rather heavy necks and elevated tail heads.

This untreated steer (above) gained 2.93 pounds per day for 70 days on full feed in the dry lot. The carcass graded prime. Note the neatness, trimness, and quality of the steer. The steer below gained 3.52 pounds per day for 70 days after treatment with 60 milligrams of stilbestrol. He looks fatter than the untreated animal, but not so neat and trim. He graded choice.

Summary of Findings

1. Beef steers on full feed treated with 60 milligrams of stilbestrol gained about ½ pound more per head per day than did similar untreated animals. The cost of this treatment was approximately 15 cents per animal. A single treatment of five 12-milligram pellets of stilbestrol implanted subcutaneously in the ear gave the best results. Heifers treated with stilbestrol did not gain so rapidly as did steers (see Graph 3).

2. It took from 100 to 300 pounds less feed for 100 pounds of gain in the treated group.

3. Carcasses from treated animals returned $3.00 to $20.00 more than did untreated carcasses (see Table 5).

4. The carcass grade of treated steers was slightly lower than that of the control animals, but the yield was the same for both groups.

5. Beef heifers and steers not supplemented with concentrates and hay on irrigated pasture did not make significantly increased gains when treated with stilbestrol.

6. Treated beef heifers on full feed in the dry lot had some difficulty with vaginal prolapse. Therefore, it is not recommended that heifers be implanted with this hormone.

7. Cattlemen who plan to use stilbestrol to increase meat production should understand that approval for its use in this manner has not been secured from the Pure Food and Drug Administration.

Researchers at other stations have reported results which indicate that only minute amounts (.01 mg/gm dried meat) of hormone are present in the meat of beef animals when treated with 60 mgs of stilbestrol and slaughtered after 140 days.*

* *Estrogenic activity of the meat of cattle, sheep, and poultry following treatment with synthetic estrogens and progesterone.* Jour. Anim. Sci., 13:138–151.

Graph 3. **Comparison of the Effect of Hormone Treatment on the Gain of Heifers vs. Steers**

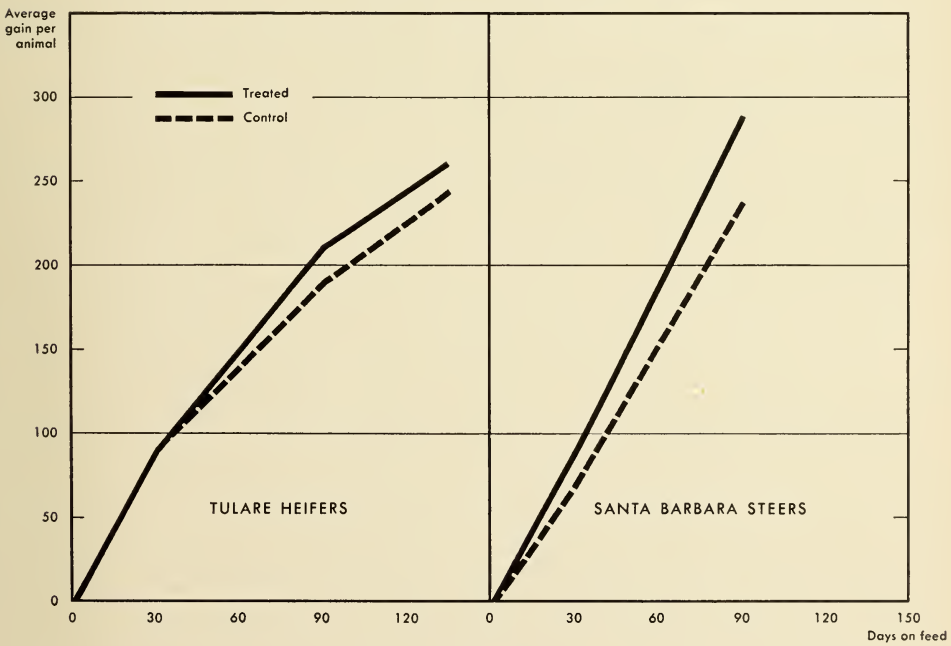


Table 5. Comparison of the Value of the Total Gain Obtained by Treated vs. Control Animals

	Gain per animal	Selling price per cwt.	Value of gain	Difference in favor of treated animals
U. C. Steers				
Control	176	$31.50	$55.44	
Treated	255	$31.50	$80.32	$24.88
Ventura Steers				
Control	284	$35.92	$102.01	
Treated	340	$35.57	$120.94	$18.93
Santa Barbara Steers				
Control	237	$34.02	$80.63	
Treated	288	$33.42	$96.25	$15.62

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